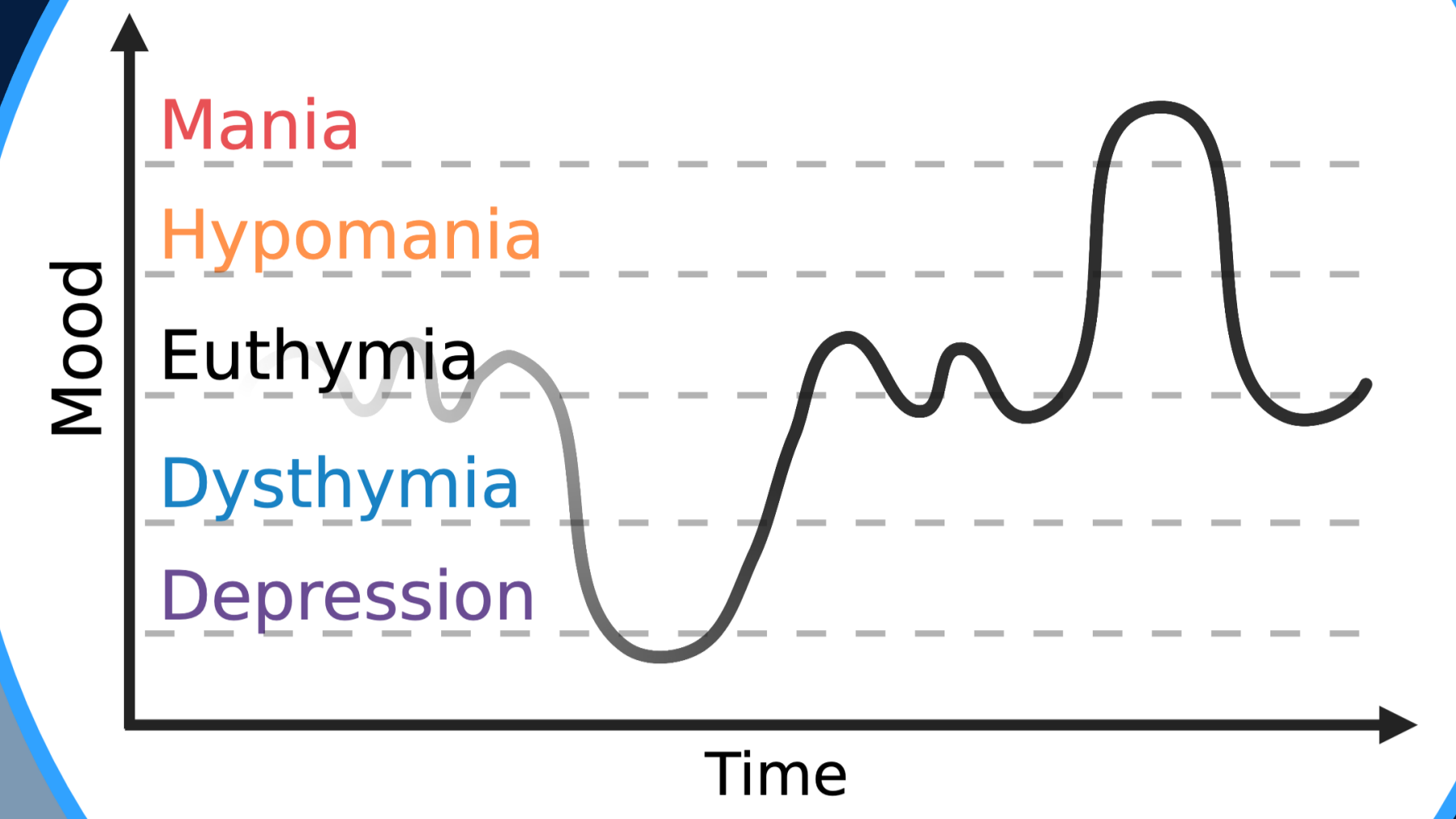


TL;DR: We infer mood disorder psychometric scales with a clinically acceptable error from multi-channel physiological data, thus providing richer psychopathology insights than a simple case-control classification.



Inferring mood disorder symptoms from multivariate time-series sensory data



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Background

- ▶ Mood disorders among the top 25 leading causes of disease burden worldwide.
- ▶ Limited clinical translation of psychiatric genetics and neuroscience research.
- ▶ Mood disorders correlate with changes in physiological parameters that wearable devices can continuously and affordably record in a patient's natural environment.

Objective

Infer mania and depression symptoms — the two main polarities of mood disorders — as measured with psychiatrist-scored questionnaires (YMRS [1] and HDRS [2]) from Empatica E4 wearables data.

Previous works:

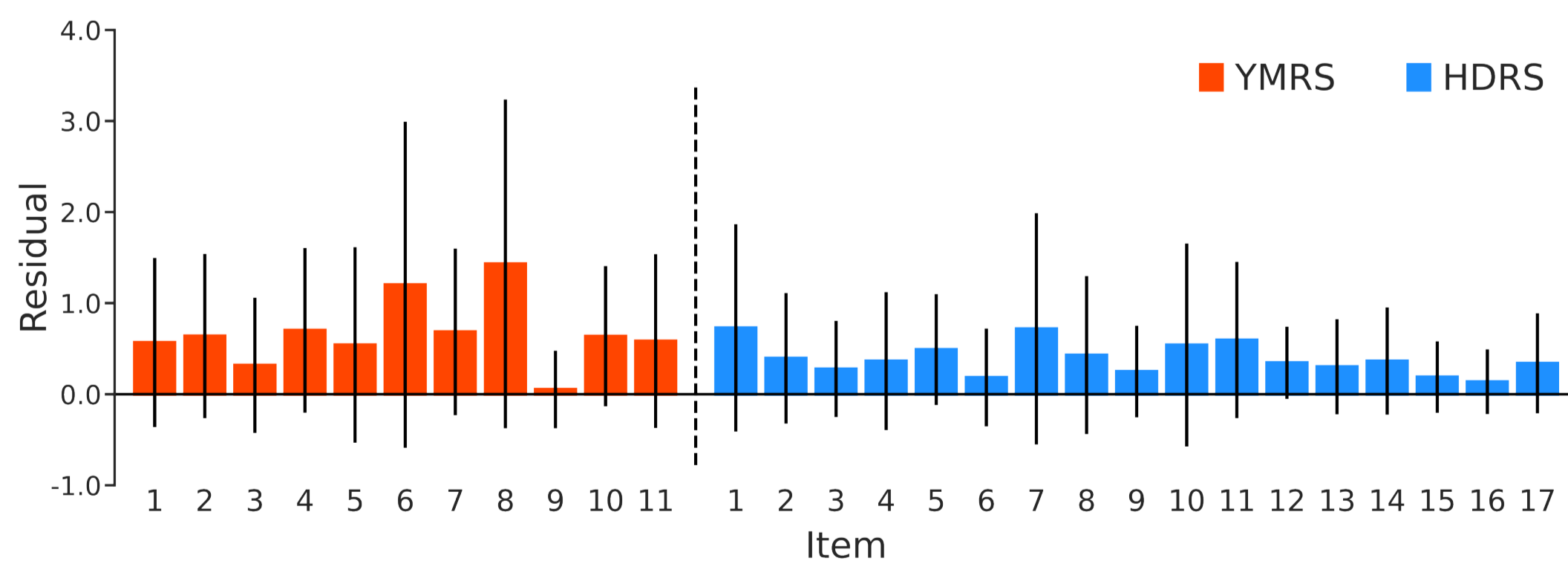
- ▶ Cases vs controls binary classification [3, 4].
- ▶ Regression of questionnaires total score [5].
- ▶ Time-aligned multivariate time-series data [6, 7].

This study:

- ▶ Multi-label: inferring individual items in YMRS and HDRS.
- ▶ Embedding representation of time-series data.

Results

Alignment	Total score		Item average	
	YMRS	HDRS	YMRS	HDRS
Manual	6.0558	4.5957	1.3336	0.8599
MLP (128)	5.8560	4.5602	1.3316	0.8561
GRU (128)	5.634	4.4089	1.3343	0.855



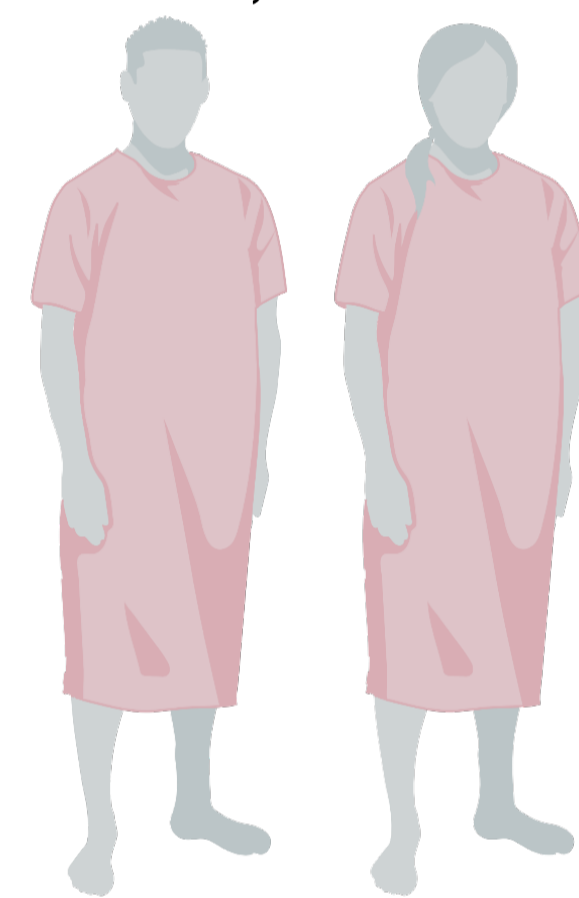
Discussion

We showed that regressing individual items in psychometric scales with a clinically acceptable error is viable.

Future directions: (1) ordinal regression, (2) link item residual to other clinical-demographic variables, (3) unsupervised data representations.

Methods

$N_{\text{patient}} = 64, N_{\text{control}} = 25$



Empatica E4

4 assessments

T0 acute episode onset

T1 clinical response onset

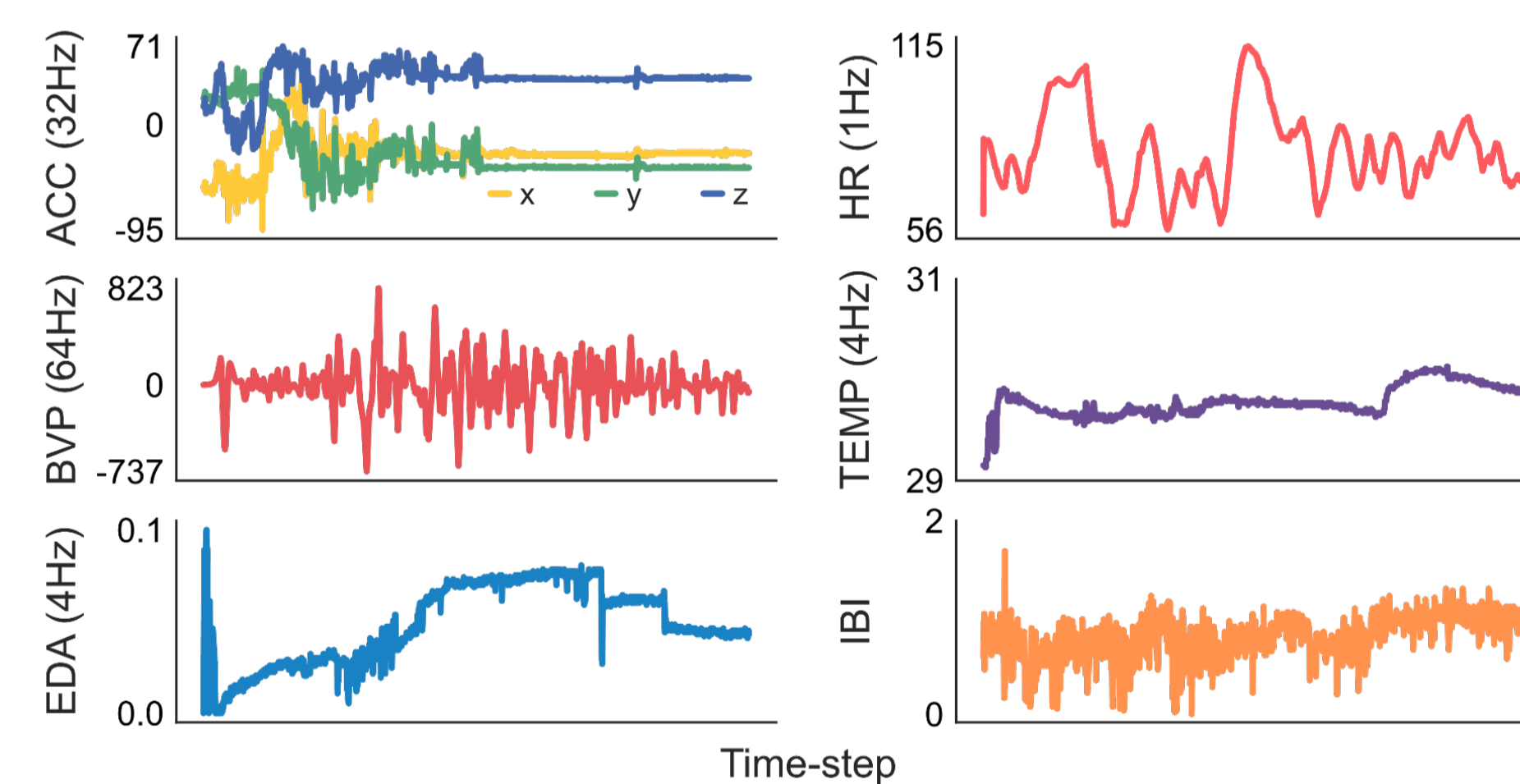
T2 discharge

T3 recovery



Questionnaire

- ▶ Age
- ▶ Sex
- ▶ ...
- ▶ Pharmacological treatment
- ▶ Psychometric scales
 - ▶ HDRS (17 items)
 - ▶ Depressed mood
 - ▶ Feelings of guilt
 - ▶ ...
 - ▶ YMRS (11 items)
 - ▶ Elevated mood
 - ▶ Increased motor activity-energy

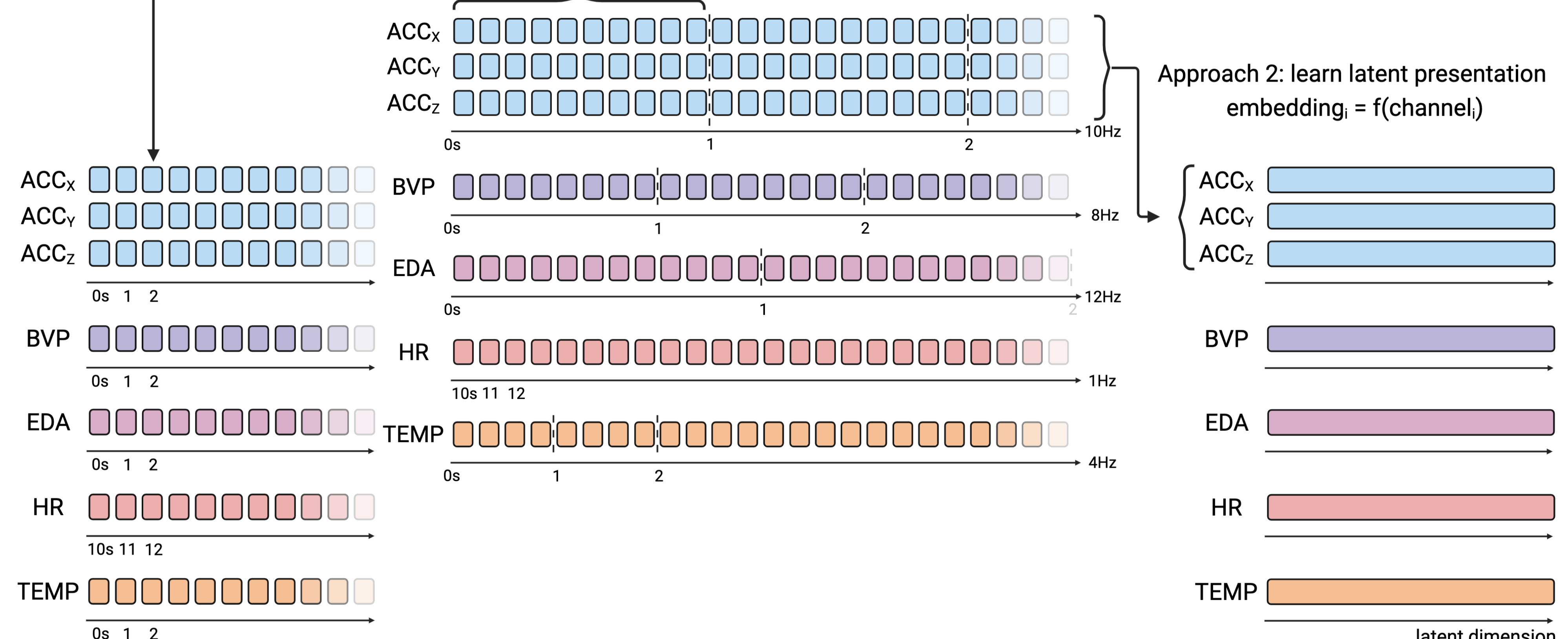


Quality Control

5 custom rules to filter out physiologically implausible data

Approach 1: manual time alignment

Filtered raw recordings



References: [1] Young et al. 1978. [2] Hamilton 1960. [3] Rykov et al. 2021. [4] Côté-Allard et al. 2022. [5] Ghandeharioun et al. 2017. [6] Adler et al. 2022. [7] Li et al. 2022.